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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/719,759	11/20/2003	Chin-Ta Su	MXICP012	3129

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EXAMINER	
MCDONALD, RODNEY GLENN	
ART UNIT	PAPER NUMBER
1753	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/13/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

10/719,759

Applicant(s)

SU, CHIN-TA

Examiner

Rodney G. McDonald

Art Unit

1753

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 February 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-17 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-17 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____.

- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on February 28, 2007 has been entered.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-4, 7-10 and 13-15 are rejected under 35 U.S.C. 102(b) as being anticipated by Giewont et al. (U.S. Pat. 6,388,327).

Regarding claims 1, 7, 8, 13, Giewont et al. teach a conventional process for formation of a cobalt silicide comprising providing a substrate having a silicon layer thereon. Precleaning the substrate. Depositing a cobalt layer thereon. Depositing a TiN capping layer on the cobalt. The conventional capping layer is not truly stoichiometric but includes additional nitrogen. (i.e. Nitrogen greater than 1 thus the TiN layer has x atoms of nitrogen for each atom of titanium greater than 0.9) . The structure is first annealed in the range of 480 to 570 degrees C. Since the capping layer includes

Art Unit: 1753

additional nitrogen, nitrogen will diffuse into and through the cobalt layer 2 during the first anneal. During the first anneal the Co diffuses into the silicon to form a layer of CoSi₁₂. Also the a nonreacted Co layer 22 is formed. The TiN layer and the unreacted Cobalt layer is removed leaving a layer of CoSi. A second anneal can then be carried out to form a layer of CoSi₂ in the range of 690 to 750 degrees C. The CoSi₂ is inherently decreased in resistance. (Column 1 lines 23-41; Column 2 lines 1-16; Column 28-51) The Ti is minimally diffused from the TiN_x layer into the silicon layer due to the layer thickness of the TiN_x layer being "about 200 Angstroms". (Column 2 lines 1-2)

Regarding claim 2, the second thermal process is performed after removing the non-reactive cobalt layer. (Column 2 lines 47-50)

Regarding claims 3, 9, 14, the TiN layer is formed by a sputtering process. (Column 1 lines 35-37)

Regarding claims 4, 10, 15, the gas used in the sputtering process is N₂ and Ar. (Column 1 lines 35-41)

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of

Art Unit: 1753

the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 5, 11 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Giewont et al. (U.S. Pat. 6,388,327).

Giewont et al. is discussed above and all is as applies above. (See Giewont et al. discussed above)

The difference not yet discussed is the ratio of the nitrogen to argon gas being "approximately 3:1".

Giewont et al. teach that to form a titanium nitride film with excess nitrogen one should operate in region III. (See Fig. 2) The nitrogen flow can be increased above 60 sccm to achieve applicant's gas ratio. (See Fig. 2)

The motivation for operating with a N₂ to Ar ratio of 3:1 is that it allow formation of a film that has excess nitrogen. (Column 2 lines 29-31)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized a ratio of 3:1 as taught by Giewont et al. because it allows formation of a film with excess nitrogen.

Claims 6, 12 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Giewont et al. (U.S. Pat. 6,388,327) in view of Besser et al. (U.S. Pat. 5,970,370).

Giewont et al. is discussed above and all is as applies above. (See Giewont et al. discussed above)

The difference between Giewont et al. and the present claims is the thickness of the TiN layer.

Regarding claims 6, 12, 17, the thickness of the TiN layer can be 100 Angstroms. (Column 5 lines 48-51)

The motivation for utilizing a particular thickness of the TiN layer is that it allows for formation of a cobalt silicide structure. (See Abstract)

Therefore, it would have been obvious to one of ordinary skill at the time the invention was made to have modified Giewont et al. by utilizing a particular thickness of the TiN layer as taught by Besser et al. because it allows for formation of a cobalt silicide structure.

Response to Arguments

Applicant's arguments filed February 28, 2007 have been fully considered but they are not persuasive.

In response to the argument that Giewont et al. do not teach how to use an at least stoichiometrically balanced TiN layer, it is argued that Giewont teach in the "Conventional process" that the TiN capping layer can have an additional amount of nitrogen in the layer which reads on Applicant's requirement for a TiN_x layer where X is greater than 0.9. The claims as written can read on a stoichiometrically balanced TiN layer or a layer where there is more nitrogen than Ti. Giewont teaches the case where

there is more N than that required by a stoichiometric layer of TiN. (See Giewont et al. discussed above)

In response to the argument that Giewont et al. do not teach the capping layer including additional nitrogen but a capping layer that is deficient in nitrogen, it is argued that Giewont teach at Column 2 line 30-32 that the capping layer can have additional nitrogen. Applicant has pointed to Column 5 lines 41-44 as showing a capping layer that is deficient in nitrogen. However the Examiner relies on the "Conventional" teaching in Giewont to show Applicant's claimed process including the capping layer can having additional nitrogen. (See Giewont discussed above; Giewont Column 2 lines 30-32)

In response to the argument that Giewont et al. teach away from the present invention because the diffusion of the nitrogen causes an undesirable oxynitride layer, it is argued that Giewont suggest that the diffusion "may result" in the formation of an oxynitride which indicates that the oxynitride layer may not result and would therefore not result in the undesirable oxynitride layer. (See Giewont discussed above)


In response to the argument that Giewont et al. do not teach the ratio of nitrogen gas to argon gas, it is argued that Giewont teach operating in the region of III in Figure 2 to produce a layer having additional nitrogen. Operating at such a range will lead to a nitrogen to argon ratio of "approximately 3:1". (See Giewont discussed above)

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rodney G. McDonald whose telephone number is 571-272-1340. The examiner can normally be reached on M- Th with Every other Friday off.

Art Unit: 1753

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



Rodney G. McDonald
Primary Examiner
Art Unit 1753

RM
March 8, 2007